54401

Form ADM-015
11/82

State of New Jersey
Department of Environmental Protection

REFERRAL FORM

Date 11/27/90

TO

Michael Gilbert
3NJCS
Emergency & Remedial Response Div.
EPA Region II
26 Federal Plaza
New York, NY 10278

FROM

Chris Holstrom
NJDEP
TELEPHONE EXT. 609 633-1455

For Your ☐ ACTION ☐ APPROVAL ☑ INFORMATION ☐ REVIEW
☐ COMMENTS ☐ SIGNATURE ☐ FILE ☐ _____

Mick,
These are the requirements for surface water ARARs. You can give it to NL, its not confidential. Any questions, give me a call.

Chris

REQUIREMENTS FOR DETERMINATION OF WATER QUALITY BASED EFFLUENT LIMITATIONS

The following information shall be submitted by the applicant for a water quality based effluent limitation, in addition to any information required pursuant to N.J.A.C. 7:14A:

1. Type of waste (domestic or industrial) to be discharged, accompanied by an analysis of the treated and untreated wastewater characteristics (analysis to include chemical specific and whole effluent toxicity testing).

2. Type of treatment process and level of treatment either existing or being considered.

3. Original U.S. Geological Survey Topographic Maps, 7.5 Quadrangle series, showing treatment facility locations, discharge point, and the location of other treatment facilities on the receiving waterbody within five miles of the existing or proposed discharge.

4. Name and classification of receiving waterbody including a description of the waterbody's existing beneficial uses.

5. Receiving waterbody analysis, which shall include:

   (a) A determination of the Critical Instream Waste Concentration (IWC - see definition below), with documentation.

   (b) A water quality analysis program to be developed in coordination with the Department and to include, at a minimum, sampling stations upstream and downstream of all existing discharges, as well as any proposed discharge.

For guidance see the U.S. Environmental Protection Agency documents given in the attached list.

Determination of Critical Instream Waste Concentration

For discharges into non-tidal streams, or small tidal streams with a cross-sectional area not greater than 1,000 square feet at mean sea level and inflow MA7CD10 (minimum average 7 consecutive day flow with a statistical recurrence interval of 10 years) not greater than 10 cubic feet per second:

$$I = \frac{Q_e}{Q_e + Q_s}$$

where I = Critical Instream Waste Concentration
Q_e = Effluent Flow
Q_s = Upstream Freshwater MA7CD10 Flow

For all other waterbodies the instream waste concentration, I, will be determined on a case-by-case basis utilizing applicable scientific methods, including, but not limited to, plume models and the mixing zone concept.

MIXING ZONE IMPLEMENTATION POLICIES FOR THE DISCHARGE OF TOXIC SUBSTANCES INTO TIDALLY INFLUENCED WATERS

Regulatory Authority

N.J.A.C. 7:14A-3.14 sets the procedures for calculating New Jersey Pollutant Discharge Elimination System (NJPDES) Discharge to Surface Water (DSW) permit conditions. Paragraph (k) states that:

"Water quality based effluent limitations applicable to discharge into surface waters of the state shall be developed in accordance with 'Wastewater Discharge Requirements', N.J.A.C. 7:9-5 and/or 'Surface Water Quality Standards', N.J.A.C. 7:9-4.

Paragraph (b) of N.J.A.C. 7:9-4.6 relates how water quality based effluent limitations are to be included in draft and final NJPDES permits and Discharge Allocation Certificates (DACs). Specifically, this paragraph states, ". .. the water quality based effluent limitations incorporated into the Final NJPDES Permit or DAC must be consistent with the provisions of N.J.A.C. 7:9-4 (including, but not limited to 7:9-4.5, 4.6(c), and 4.9). Paragraph (c)4 of N.J.A.C. 7:9-4.5 contains the mixing zone policies. Although mixing zone requirements are determined on a case-by-case basis, the purpose of this implementation policy is to assure consistency among dischargers while providing for attainment and maintenance of water quality criteria and standards.

This implementation policy will also be used in the development of water quality based whole effluent toxicity limitations, where appropriate, to determine the instream waste concentration in accordance with N.J.A.C. 7:9-4.6(c)5ii(2).

Implementation Policy

The mixing zone implementation policy is based on and is consistent with the following U.S. Environmental Protection Agency (EPA) publications:

Technical Support Document for Water Quality-based Toxics Control, September 1985, EPA-440/4-85-032

Permit Writer's Guide to Water Quality-Based Permitting for Toxic Pollutants, July 1987, EPA-440/4-87-005

Water Quality Standards Handbook, December 1983

The following mixing zone implementation policies are to be applied during critical conditions. Critical conditions are those that produce minimal dilution and/or have maximum environmental impact on aquatic life and the designated uses of the receiving waterbody.

For submerged outfalls using a high-rate diffuser (exit velocity greater than 10 feet per second) chronic criteria will be applied at the edge of the mixing zone. The edge of the mixing zone being defined as the point where the effluent plume is indistinguishable from background conditions measured with a conservative dye. Acute criteria will be applied at the edge of the zone of initial dilution (ZID). The ZID is the region of initial mixing surrounding or adjacent to the end of the outfall diffuser. Initial dilution is the flux-averaged dilution (averaged over the cross-sectional area of the plume) achieved during

the period when dilution is primarily a result of plume entrainment (i.e. mixing is due to the initial momentum and buoyancy of the plume).

For submerged outfalls that do not have a high-rate diffuser chronic criteria will be applied at the ZID and acute criteria will be applied at the end-of-pipe.

Use of the ZID and edge of mixing zone as physical mixing zone dimensions must conform to the following mixing zone policies as stated in N.J.A.C. 7:9-4.5(c)4:

iii. The total area and volume of a waterway or waterbody assigned to mixing zones shall be limited to that which will not interfere with biological communities or populations of important species to a degree which is damaging to the ecosystem or which diminishes other beneficial uses disproportionately. Furthermore, significant acute mortality of aquatic biota shall not occur within the mixing zone.

iv. Zones of passage shall be provided for the passage of free-swimming and drifting organisms wherever mixing zones are allowed.

Physical mixing zones that occupy less than 1/4 the cross-sectional area of a waterbody up to a maximum of 100 meters in any direction from the discharge outlet structure are assumed to be in compliance with the above narrative.

For discharges that are not submerged, both chronic and acute criteria will be applied at the end-of-pipe unless site specific conditions warrant otherwise.

PROCEDURES AND REQUIREMENTS FOR CONDUCTING WATER QUALITY ANALYSIS PROGRAMS AND DILUTION STUDIES

Critical Conditions

Critical conditions are those that produce minimal dilution and/or cause the maximum environmental impact on aquatic life and the designated uses of the receiving waterbody. One of the primary concerns in defining critical conditions is stratification of the receiving waterbody. For the purposes of this document stratification refers to salinity and/or thermal variations which occur over a vertical profile in the receiving waterbody.

For non-tidal waterbodies critical conditions are periods of low fresh water flows. These conditions generally occur between September 1 and October 15.

For tidal, non-stratified waterbodies minimal dilution occurs when fresh water inflows are at a minimum and a low water slack period during a spring tide occurs. These conditions should occur between September 1 and October 15. Also, to determine the maximum areal extent of the plume, maximum velocity during a tidal cycle should be examined.

For tidal, stratified waterbodies minimal dilution may occur at either minimal fresh water flows or at times of maximum stratification. In addition to the above non-stratified conditions the following should also be examined. For estuaries and tidal portions of streams that are likely to be salinity stratified maximum stratification would occur during periods of high fresh water inflows at low water slack during a neap tide. This should occur between March 1 and April 15. For coastal waters that are likely to be thermally stratified maximum stratification should occur between May 1 and August 1.

Water Quality Analysis Program

Additional specific guidance for conducting water quality analysis programs is found in the following publications:

Field Procedures Manual For Water Data Acquisition, NJDEP-Division of Water Resources. This manual is available through the Bureau of Monitoring Management, P.O. Box CN029, Trenton, NJ 08625

USEPA Handbook - Stream Sampling for Waste Load Allocation Applications

The guidance given here represents minimum requirements for water quality sampling. Additional requirements may be necessary on a case by case basis. Sampling must occur during critical conditions.

Frequency of sampling shall be weekly for 12 weeks. The 12 week period need not be consecutive as long as each sampling period contain a minimum of 4 weekly samples. Water column samples shall be analyzed for all parameters for which a surface water quality criteria exists (see Appendix A). Sediment samples shall be taken and analyzed for the appropriate parameters during any 3 water quality samplings.

For non-tidal waterbodies, at a minimum, samples shall be taken at the point of discharge

(existing or proposed) and at least one location upstream and one location downstream. For tidal waterbodies, at a minimum, samples shall be taken at the point of discharge (existing or proposed) at high, low, and slack tides. Depending on site specific conditions, additional samples may be required to define loads from other point sources, tributaries, non-point sources, etc.

For an existing discharge the effluent shall be sampled and analyzed concurrently with each water column sampling.

Dye Studies

To conduct effluent dilution studies for mixing zone considerations and determination of critical Instream Waste Concentrations (IWC) requires the release and sampling of a conservative tracer dye during critical conditions and use of a computer model to simulate the movement of the effluent plume under various conditions.

The release and sampling of a conservative tracer dye is used to determine the mixing characteristics and movement of an effluent plume in a receiving waterbody. The results of a dye study are also used to calibrate and verify computer simulation models that can be used to describe the behavior of the effluent plume for conditions not sampled using dye. In order to conduct the study a conservative dye must be continuously introduced into the effluent maintaining a constant concentration in the effluent. The effluent discharge rate should be kept at as constant a rate as possible at a level that reflects the average discharge rate. Dye concentrations in the receiving waterbody should be sampled and analyzed in sufficient number, horizontal and vertical extent, and time duration to delineate the ZID and the edge of the mixing zone. The recommended dye is Rhodamine WT. Use of another dye requires that the following information be submitted 21 days prior to the planned release of dye:

1. Name of dye.
2. Physical characteristics of the dye.
3. Available toxicity information on the dye.
4. Concentration at which dye is visible.
5. Planned concentration and total mass of dye to be discharged in the effluent.

Before any dye is released the appropriate Bureau of Regional Enforcement shall be notified at least 48 hours prior to release of dye.

Metro Bureau - (201) 669-3900
Bergen, Essex, Hudson, Union Counties

Central Bureau - (609) 426-0786
Burlington, Mercer, Middlesex, Monmouth, Ocean Counties

Northern Bureau - (201) 299-7592
Hunterdon, Morris, Passaic, Somerset, Sussex, Warren Counties

Southern Bureau - (609) 346-8032
Atlantic, Camden, Cape May, Cumberland, Gloucester, Salem Counties

Computer Models

There exists several models developed for USEPA that simulate effluent plumes from submerged or surface discharges. The following are the minimum data requirements to use the models:

Ambient current speed and direction Outfall characteristics
Number of ports
Port effective diameter
Port spacing
Port orientation
Discharge depth
Effluent flowrate
Density (or salinity and temperature) of effluent
Density (or salinity and temperature) gradient in receiving waterbody

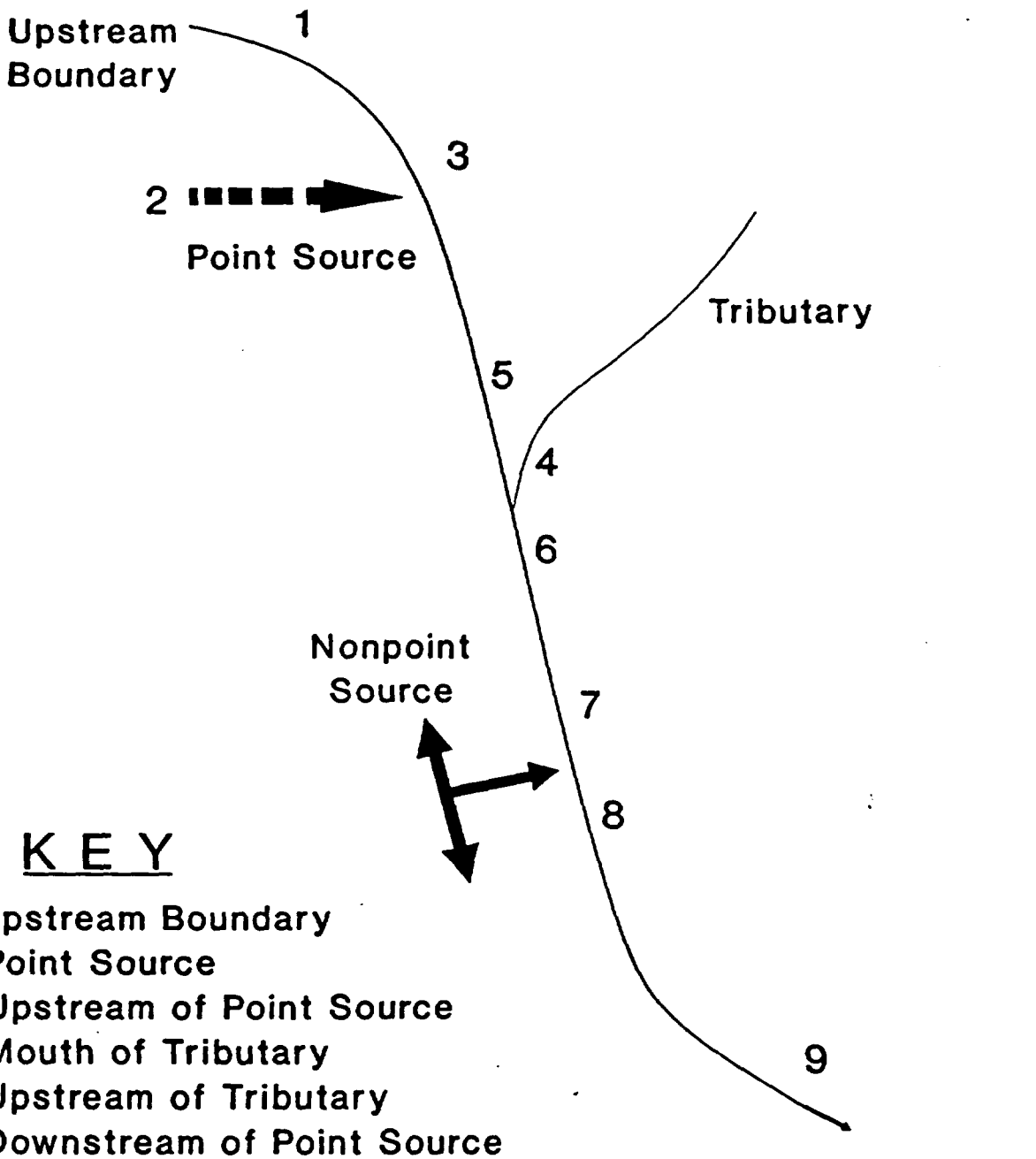
For submerged outfalls the following USEPA models are available:

PLUME, OUTPLM, DKHDEN, MERGE, LINE

For surface discharges the following USEPA models are available:

PDS, PDSM, MOBEN, PSY

Recommended Locations for Sampling Program



KEY

1. Upstream Boundary
2. Point Source
3. Upstream of Point Source
4. Mouth of Tributary
5. Upstream of Tributary
6. Downstream of Point Source
   (at O2 Sag Point for D.O. Analysis)
7. Upstream of Nonpoint Source
8. Downstream of Nonpoint Source
9. Downstream of Study Area

The following EPA documents can be obtained from : National Technical Information Service (NTIS), 5285 Port Royal Road, Springfield, VA 22161, (703) 487-4650.

TITLE	EPA NUMBER	NTIS REFERENCE NUMBER
Technical Guidance Manual for Performing Waste-load Allocations - Book II Streams and Rivers - Chapter 1 Biochemical Oxygen Demand/Dissolved Oxygen	EPA 440/4-84-020	PB86178936
Technical Guidance Manual for Performing Waste-load Allocations - Book II Streams and Rivers - Chapter 2 Nutrient/Eutrophication Impacts	EPA 440/4-84-021	PB86178944
Technical Guidance Manual for Performing Waste-load Allocations - Book II Streams and Rivers - Chapter 3 Toxic Substances	EPA 440/4-84-022	PB86170628
Technical Guidance Manual for Performing Waste-load Allocations - Book IV Lakes and Impoundments - Chapter 2 Nutrient/Eutrophication Impacts	EPA 440/4-84-019	PB86178928
Technical Guidance Manual for Performing Waste-load Allocations - Book VII Permit Averaging	EPA 440/4-84-023	PB86178951
Water Quality Assessment: A Screening Procedure for Toxic and Conventional Pollutants in Surface and Ground Water - Part I and Part II (Revised 1985)	EPA 600/6-85/002a EPA 600/6-85/002b	PB86122496 PB86122504
Technical Support Document for Water Quality-Based Toxics Control	EPA 440/4-85-032	PB86150067
Initial Mixing Characteristics of Municipal Ocean Discharges		
Volume 1 - analytical solutions and descriptions of the five models: PLUME, OUTPLM, LINE, MERGE, and DKHDEN	EPA 600/3-85-073a	PB86137478
Volume 2 - FORTRAN IV program listings of the 5 models	EPA 600/3-85-073b	PB86137460
IBM-PC compatible diskettes containing the 5 models		PB86137486
Handbook - Stream Sampling for Waste Load Allocation Applications	EPA 625/6-86-013	
Revised Section 301(h) Technical Support Document	EPA 430/9-82-011	

APPENDIX A - N J SURFACE WATER QUALITY CRITERIA (all values in ug/l unless otherwise noted)

PARAMETER	AQUATIC LIFE PROTECTION FRESH WATER		AQUATIC LIFE PROTECTION SALT WATER		HUMAN HEALTH PROTECTION	NOTES
	Acute	Chronic	Acute	Chronic		
Volatile Compounds						
Acrolein					320	h2
Acrylonitrile					0.059056779	h4
Benzene					0.149644914	h1
Bis (Chloromethyl) Ether						
Bromoform					see Halomethanes	
Carbon Tetrachloride					0.362246654	h1
Chlorobenzene						
Chlorodibromomethane					see Halomethanes	
Chloroethane						
2-Chloroethylvinyl Ether						
Chloroform					5.666618629	h4
Dichlorobromomethane						
Dichlorodifluoromethane						
1,1-Dichloroethane						
1,2-Dichloroethane					0.290533586	h1
1,1-Dichloroethylene					4.812414064	h1
1,2-Dichloropropane						
1,3-Dichloropropylene					0.193188718	h4
Ethylbenzene					3026.183844	h4
Methyl Bromide					48.06277587	h4
Methyl Chloride					see Halomethanes	
Methylene Chloride					2.492628053	h1
1,1,2,2-Tetrachloroethane					0.17	h2
Tetrachloroethylene					0.388220718	h1
Toluene					9808.895654	h4
1,2-Trans-Dichloroethylene						
1,1,1-Trichloroethane					127.1852288	h1
1,1,2-Trichloroethane					13.45324627	h4
Trichloroethylene					1.091432412	h1
Trichlorofluoromethane						
Vinyl Chloride					0.083017659	h1
Acid Compounds						
2-Chlorophenol					170.24174	h2
2,4-Dichlorophenol					3090	h2
2,4-Dimethylphenol						
4,6-Dinitro-O-Cresol					13.4	h2
2,4-Dinitrophenol					69.65815262	h4
2-Nitrophenol					See Nitrophenols	
4-Nitrophenol					See Nitrophenols	
P-Chloro-M-Cresol						
Pentachlorophenol	exp(1.005pH-4.83)	exp(1.005pH-5.29)	13	7.9	1013.758146	a2,h4
Phenol					20904.88278	h4
2,4,6-Trichlorophenol					1.176470588	h4
Base/Neutral Compounds						
Acenaphthene						
Benzidine	0.1				0.1	a3,h3
Benzo (a) Anthracene					see PAH's	
Benzo (a) Pyrene					see PAH'S	
Benzofluoranthene						
Benzo (ghi) Perylene					see PAH'S	
Benzo (k) Fluoranthene					see PAH'S	
Bis (2-Chloroethoxy) Methane						
Bis (2-Chloroethyl) Ether					0.031120309	h4

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PARAMETER	AQUATIC LIFE PROTECTION FRESH WATER		AQUATIC LIFE PROTECTION SALT WATER		HUMAN HEALTH PROTECTION	NOTES
	Acute	Chronic	Acute	Chronic		
Bis (2-Chloroisopropyl) Ether					34.7	h2
Bis (2-Ethlyhexyl) Phthalate					1.757469244	h4
4-Bromophenyl Phenyl Ether						
Butyl Benzyl Phthalate						
2-Chloronaphthalene						
4-Chlorophenyl Phenyl Ether						
Chrysene					see PAH'S	
Dibenzo (a,h) Anthracene					see PAH'S	
1,2-Dichlorobenzene					2549.33514	h1
1,3-Dichlorobenzene					2654.555075	h1
1,4-Dichlorobenzene						
3,3'-Dichlorobenzidine					0.01	h2
Diethyl Phthalate					21216.40736	h4
Dimethyl Phthalate					313000	h2
Di-N-Butyl Phthalate					3257.70797	h4
2,4 Dinitrotoluene					0.11	h2
2,6-Dinitrotoluene						
Di-B-Octyl Phthalate						
1,2-Diphenythydrazine						
(as Azobenzene)					0.040474594	h4
Fluoranthene					42	h2
Fluorene						
Hexachlorobenzene					0.929614874	h4
Hexachlorobutadiene					6.937321302	h4
Hexachlorocyclopentadiene					206	h2
Hexachloroethane					2.729204437	h4
Indeno (1,2,3-cd) Pyrene					see PAH'S	
Isophorone					5200	h2
Naphthalene						
Nitrobenzene					15.95018786	h4
N-Nitrosodimethylamine					0.000686217	h4
N-Nitrosodi-N-Propylamine					0.004926036	h4
N-Nitrosodiphenylamine					4.953437686	h4
Phenanthrene						
Pyrene					see PAH'S	
1,2,4-Trichlorobenzene					30.64574973	h1
Pesticides						
Aldrin	0.0019		0.0019		0.000000135	a3,h4
Alpha-BHC					0.003905487	h4
Beta-BHC					0.0163	h2
Gamma-BHC	0.08		0.004		0.738137083	a3,h4
Delta-BHC						
Chlordane	0.0043		0.004		0.000276839	a3,h1
4,4'-DDT	0.001		0.001		0.000587564	a3,h4
4,4'-DDE					0.000174699	h4
4,4'-DDD					0.001384603	h4
Dieldrin					0.000135219	h4
Endosulfan, total	0.056		0.0087		0.932090546	a3,h4
Alpha-Endosulfan						
Beta-Endosulfan						
Endosulfan Sulfate						
Endrin	0.0023		0.0023		0.629383205	a3,h4
Endrin Aldehyde						
Heptachlor	0.0038		0.0036		0.000207962	a3,h4
Heptachlor Epoxide					0.003460405	h4
PCB-1242					See Total PCB's	

PARAMETER	AQUATIC LIFE PROTECTION FRESH WATER		AQUATIC LIFE PROTECTION SALT WATER		HUMAN HEALTH PROTECTION	NOTES
	Acute	Chronic	Acute	Chronic		
PCB-1254					See Total PCB's	
PCB-1221					See Total PCB's	
PCB-1232					See Total PCB's	
PCB-1248					See Total PCB's	
PCB-1260					See Total PCB's	
PCB-1016					See Total PCB's	
Toxaphene	0.013		0.005		0.000730194	a3,h4
Metals, Cyanide and Total Phenols						
Antimony, total					12.21031647	h4
Arsenic, trivalent	360	190	69	36		a2
Arsenic, total					50	h3
Beryllium, total					0.0068	h2
Cadmium, total	Hardness Dependent-See Appendix B		43	9.3	10	a2,h3
Chromium, trivalent	Hardness Dependent-See Appendix B					a2
Chromium, hexavalent	16	11	1100	50		a2
Chromium, total					50	h3
Copper, total	Hardness Dependent-See Appendix B		2.9			a2
Lead, total	Hardness Dependent-See Appendix B		140	5.6	50	a2,h3
Mercury, total	2.4	0.012	2.1	0.025	2	a2,h3
Nickel, total	Hardness Dependent-See Appendix B		75	8.3	516.1570158	a2,h4
Selenium, total	20	5	300	71	10	a1,h3
Siver, total	4		2.3		50	a2,h3
Thallium, total					13	h2
Zinc, total	Hardness Dependent-See Appendix B		95	86		a2
Cyanide, total	22	5.2	1		767.5056068	h4
Total Phenols						
Conventional Pollutants						
Biochemical Oxygen Demand						
Total Suspended Solids - mg/l	25 - FW2-TP, TM 40 - FW2-NT					
pH - standard units	6.5 to 8.5 for SE and FW2 waters, natural pH conditions for SC waters					a3
Fecal Coliform						
Oil and Grease						
Non-Conventional Pollutants						
Total Organic Nitrogen						
Total Organic Carbon						
Chemical Oxygen Demand						
Dissoved Oxygen - mg/l	Not less than 7.0 at any time				FW2 - TP	a3
	24 hour average not less than 6.0. Not less than 5.0 at any time				FW2 - TM	a3
	24 hour average not less than 5.0, but not less than 4.0 at any time.				FW2 - NT	a3
	Not less than 4.0 at any time.				SE2, Tidal portions of FW2-NT tribs to Delaware R. between Rancocas Cr and Big Timber Cr inclusive	a3
	Not less than 5.0 at any time				SC	a3
	Not less than 3.0 at any time				SE3	a3
Total Dissoved Solids - mg/l	FW2 waters - 133% of background up to 500 mg/l					a3,h3
Temperature						
Chloride - mg/l					250	h3
Bromide						
Chlorine Produced Oxidants						
(Total Residual Chlorine)	11		7.5			a3
for						

APPENDIX A - N J SURFACE WATER QUALITY CRITERIA (all values in ug/l unless otherwise noted)

PARAMETER	AQUATIC LIFE PROTECTION FRESH WATER		AQUATIC LIFE PROTECTION SALT WATER		HUMAN HEALTH PROTECTION	NOTES
	Acute	Chronic	Acute	Chronic		
Ammonia (as N)	FW2-TP,TM - 20 ; FW2-NT - 50					a3
Flouride						
Nitrate-Nitrite (as N)						
Petroleum Hydrocarbons						
Total Phosphorous (as P)	FW2 waters - lakes, ponds, reservoirs - 50, streams - 100					a3
Sulfate (as SO4) - mg/l					250	h3
Sulfide (as S)						
Sulfite (SO3)						
Surfactants						
Total Aluminum						
Total Barium						
Total Boron						
Total Cobalt						
Total Iron						
Total Magnesium						
Total Molybdenum						
Total Manganese						
Total Tin						
Total Titanium						
Total PCB's	0.014		0.03		0.000244141	a3,h1,h4
Total PAH's					0.0028	h2
Total Nitrophenols					70	h2
Total Halomethanes					0.19	h2
Dioxin						
2,3,7,8-Tetrachlorodibenzo						
-P-Dioxin					0.000000013	h2

HUMAN HEALTH NOTES
h1 - A280 Chemical
h2 - EPA 304(a) criteria
h3 - NJ Surface Water Quality Standard
h4 - IRIS updated criteria

AQUATIC LIFE NOTES
a1 - AQUIRE updated criteria
a2 - EPA 304(a) criteria
a3 - NJ Surface Water Quality Standard

APPENDIX B - FRESHWATER AQUATIC CRITERIA FOR HARDNESS DEPENDENT METALS IN UG/L

RECEIVING WATER HARDNESS, mg/l as CaCO3

	50	60	70	80	90	100	110	120	130	140	150	160	170	180	190	200
CADMIUM																
Acute	1.8	2.2	2.6	3.0	3.5	3.9	4.4	4.8	5.3	5.7	6.2	6.7	7.1	7.6	8.1	8.6
Chronic	0.66	0.76	0.86	0.95	1.0	1.1	1.2	1.3	1.4	1.5	1.6	1.6	1.7	1.8	1.9	2.0
CHROMIUM, TRI																
Acute	980	1100	1300	1400	1600	1700	1900	2000	2200	2300	2400	2600	2700	2800	2900	3100
Chronic	120	140	150	170	190	210	220	240	260	270	290	300	320	330	350	370
COPPER																
Acute	9.2	11	13	14	16	18	19	21	23	24	26	28	29	31	32	34
Chronic	6.5	7.6	8.7	9.8	11	12	13	14	15	16	17	18	19	20	20	21
LEAD																
Acute	34	43	52	61	71	82	92	100	110	130	140	150	160	170	180	200
Chronic	1.3	1.7	2.0	2.4	2.8	3.2	3.6	4.0	4.4	4.9	5.3	5.8	6.3	6.7	7.2	7.7
NICKEL																
Acute	790	920	1000	1200	1300	1400	1500	1700	1800	1900	2000	2100	2200	2300	2400	2500
Chronic	88	100	120	130	140	160	170	180	200	210	220	230	250	260	270	280
ZINC																
Acute	65	76	87	97	100	120	130	140	150	160	160	170	180	190	200	210
Chronic	59	69	78	88	97	110	110	120	130	140	150	160	170	170	180	190